DOE F 1325.8
(8-89)
EFG (07-90)

United States Government **Department of Energy**

Memorandum

DATE: AUG 0 7 2008

REPLY TO ATTN OF: EM-63 (Dr. James M. Shuler, 301-903-5513)

SUBJECT: Revision 20, DOE Certificate of Compliance No. 9975-85

TO: Patrick W. McGuire, Savannah River Operations Office

In response to the February 11, 2008 Cheryl C. Cabbil, Acting Laboratory Director, Transmittal of Addendum 2 to the Safety Analysis Report of Packaging (SARP) for Model 9975, WSRC-SA-2002-00008, Revision 0, May 2008 to Dr. James M. Shuler of February 11, 2008; Revision 20 of Certificate of Compliance USA/9975/B(M)F-85 (DOE) for the 9975 package has been issued to add the contents Uranium 233 oxides and metals as specified in the new Content Envelop C.9. A copy of Revision 20 of the DOE CoC USA/9975/B(M)F-85 (DOE), the Safety Evaluation Report and the Approval Record is attached.

If you have any questions, please call Dr. James M. Shuler at (301) 903-5513.

Sincerely,

Dae Y. Chung
Headquarters Certifying Official
Deputy Assistant Secretary
Office of Safety Management and Operations for
Environmental Management

Attachment

cc w/att.:
J. Shuler, EM-63
P. Mann, NA-124
C. Cabbil, SRNL
A. Gunter, SR
S. Bellamy, WSRC

DOE F 5822.1
(5-85)
Formerly EV-618)

U.S. DEPARTMENT OF ENERGY
CERTIFICATE OF COMPLIANCE
For Radioactive Materials Packages

OMB Approval
No. 1910-2000

1a. Certificate Number	1b. Revision No.	1c. Package Identification No.	1d. Page No.	1e. Total No. Pages
9975	20	USA/9975/B(M)F-85 (DOE)	1	10

2. PREAMBLE

2a. This certificate is issued under the authority of 49CFR Part 173.7(d).

2b. The packaging and contents described in item 5 below meet the safety standards set forth in subpart E, "Package Approval Standards" and subpart F, "Package and Special Form Tests" Title 10, Code of Federal Regulations, Part 71.

2c. This certificate does not relieve the consignor from compliance with any requirement of the regulations of the U.S. Department of Transportation or other applicable regulatory agencies, including the government of any country through or into which the package will be transported.

3. This certificate is issued on the basis of a safety analysis report of the package design or application --

(1) Prepared by *(Name and address)*:	(2) Title and Identification of report or application:	(3) Date:
U.S. Department of Energy Savannah River Operations Office P.O. Box A Aiken, South Carolina 29808	Safety Analysis Report for Packaging Model 9975, B(M)F-85 WSRC-SA-2002-00008, Revision 0, December 2003, as supplemented [see 5(e)]	Dec. 2003

4. CONDITIONS

This certificate is conditional upon the fulfilling of the applicable Operational and Quality Assurance requirements of 49CFR parts 100-199 and 10CFR Part 71, and the conditions specified in item 5 below.

5. Description of Packaging and Authorized Contents, Model Number, Transport Index, Other Conditions, and References:

(a) Packaging

(1) Model: 9975

(2) Description:

The components of the packaging include the drum, insulation, bearing plates, primary containment vessel (PCV), secondary containment vessel (SCV), lead shielding, and aluminum honeycomb spacers. An aluminum PCV sleeve or 3013 top and bottom spacer may be used, depending on the type of product can to be transported. The nominal net weight of the packaging ranges from 159-168 kg (350-370 lb). The drum is fabricated as a 132-liter (35-gallon) bolted lid drum of 18-gauge Type 304L stainless steel. Four 1.3-cm (1/2-in.) diameter vent holes are drilled into the drum, approximately 90 degrees apart, 2.5 cm (1 in.) below the drum flange and are covered with plastic Caplugs (fusible plugs). The plugging devices prevent water from entering the drum through the vent holes under normal conditions of transport. In the event a fire occurs, the plugs melt, allowing the drum to vent gases generated from the insulation to prevent rupture of the

6a. Date of Issuance: AUG 0 7 2008	6b. Expiration Date: March 31, 2011

FOR THE U.S. DEPARTMENT OF ENERGY

7a. Address *(of DOE Issuing Office)*	7b. Signature, Name, and Title *(of DOE Approving Official)*
U.S. Department of Energy Office of Safety Management and Operations, EM-60 1000 Independence Avenue, SW Washington, DC 20585	Dae Y. Chung Headquarters Certifying Official Deputy Assistant Secretary, Office of Safety Management and Operations Office of Environmental Management

drum. The drum lid is bolted to a 3.2-cm (1.25-in.) wide by 0.3-cm (1/8-in.) thick angle flange welded to the top of the drum body using 24 1.3-cm (1/2-in.) high-strength bolts. The lid is recessed 1.4 cm (0.55 in.). A 0.3-cm (1/8-in.) thick by 3.2-cm (1.25-in.) wide circular ring is welded to the outer section of the lid. The ring serves to reinforce the lid and prevents the lid from shearing away from the bolts during a hypothetical accident condition event. Nuts are tack welded to the flange underside to ease assembly operations. The bolts are tightened to 40.7 ± 2.7 N-m (30 ± 2 ft-lbs) of torque.

The insulation material that surrounds the containment vessels is cane fiberboard, which is manufactured per ASTM Specification C-208-95. The fiberboard is regular grade wall sheathing material with a nominal density of 0.24 g/cm^3 (15 lb/ft^3). The cane fiberboard insulation comes in 1.3-cm (1/2-in.) thick sheets that are bonded together into top and bottom subassemblies with a water-based carpenter's glue. The insulation subassemblies are fitted to the drum so that the radial clearances between the insulation, the lead cylinder, and the drum do not exceed 0.6 cm (1/4 in.). The radial thickness of the insulation is 12.1 cm (4-3/4 in.). In the axial direction, the top thickness of cane fiberboard is 9.4 cm (3.7 in.) and the bottom thickness is 8.6 cm (3.4 in.). Placed over and glued to the top fiberboard subassembly is an air shield made of stainless steel.

The radiation shielding configuration is a lead cylinder assembly that surrounds the PCV/SCV double containment assembly. The shielding assembly consists of an approximately 19.1-cm (7-1/2-in.) ID x 20-gauge 304L stainless steel cylinder with a 20-gauge bottom, surrounded by 1.19 to 1.30 cm (0.47 to 0.51 in.) of lead. An aluminum lid, 1.3 cm (1/2 in.) thick, completes the assembly. The lid has four equally spaced bolt holes near the edge for attachment to the cylinder body (1/4-20 UNC threaded steel inserts). The shielding assembly has no lead top piece as the thicknesses of stainless steel in the PCV and SCV closure provide equivalent shielding.

Two 1.3-cm (1/2-in.) thick aluminum bearing plates are added to the packaging to provide additional load-bearing surfaces against the cane fiberboard insulation.

The PCV consists of a stainless steel pressure vessel that is designed, analyzed, and fabricated in accordance with Section III, Subsection NB of the ASME Boiler and Pressure Vessel Code (B&PVC), 1992 edition, with a design condition of 900 psig at 300°F. The PCV is fabricated from 12.7-cm (5-in.), Schedule 40, seamless, Type 304L stainless steel pipe [0.66-cm (0.258-in.) nominal wall] and has a standard Schedule 40, Type 304L stainless steel pipe cap [0.66-cm (0.258-in.) nominal wall] at the blind end. A 304L stainless steel cone seal flange is welded at the open end. Both vessel body joints are circumferential full-penetration butt welds examined by radiographic and liquid penetrant methods. These welds satisfy ASME B&PVC Section III, Subsection NB requirements.

A 10.2-cm (4-in.), Schedule 40 pipe of the same material is welded to the convex side of the cap to form a skirt to vertically support the PCV.

The PCV closure consists of a male-female cone joint with surfaces that have been machined to identical angles so that they mate with zero clearance. Two grooves for O-rings have been machined into the face of the Type 304L stainless steel male cone. A leak test port is provided between the two O-ring grooves. A small [0.160-cm wide by 0.152-cm deep (0.063-in. wide by 0.060-in. deep)] rectangular groove is recessed into the face of the male cone between the two O-ring grooves, to ensure helium detection during leakage testing. Two Viton® GLT and/or Viton® GLT-S fluoroelastomer O-rings (greased with high-vacuum silicone grease) are placed in the grooves to form a leaktight seal (less than 10^{-7} ref. cm^3/sec air). A Nitronic 60 seal nut, which forces the male cone against the female cone, is threaded into the containment vessel body. The PCV has a gross internal volume of 5.1 liters (313.38 in^3), weighs 15.4 kg (33.9 lb), and is 47.3 cm (18.63 in.) long, with a usable inside cavity 38.1 cm (15 in.) deep with a minimum diameter of 12.8 cm (5.02 in.). For certain oxide contents, the PCV (or PCV and SCV) is backfilled with an inert gas prior to closing.

An aluminum honeycomb spacer is inserted into the concave cavity of the PCV to provide a flat horizontal surface for the product cans. For some containment vessels, an additional bottom spacer is used.

The SCV consists of a stainless steel pressure vessel that is designed, analyzed, and fabricated in accordance with Section III, Subsection NB of the ASME B&PVC, 1992 edition, with design conditions of 800 psig at 300°F. The SCV is fabricated from 15.2-cm (6-in.), Schedule 40, seamless, Type 304L stainless steel pipe [0.71-cm (0.280-in.) nominal wall] and has a standard Schedule 40, Type 304L stainless steel pipe cap [0.71-cm (0.280-in.) nominal wall] at the blind end. A 304L stainless steel cone seal flange is welded at the open end. Both vessel body joints are circumferential full-penetration butt welds examined by radiographic and liquid penetrant methods. These welds satisfy ASME B&PVC Section III, Subsection NB requirements.

A 12.7-cm (5-in.), Schedule 40 pipe of the same material is welded to the convex side of the cap to form a skirt to vertically support the SCV. The SCV closure is identical to that used on the PCV except that the SCV is 2.5 cm (1 in.) larger in diameter.

The SCV has a gross internal volume of 9.9 liters (604.4 in^3), weighs 24.5 kg (54.1 lb), and is 61.0 cm (24.0 in.) long.

The aluminum honeycomb impact absorbers that fit axially between the PCV and SCV are fabricated from 0.008-cm (0.003-in.) minimum foil thickness. The impact absorbers are rated for an axial compressive strength before deformation of 10.3 ± 3.4 MPa (1500 ± 500 psi). The top impact absorber has the shape of a ring. The bottom impact absorber is machined on the bottom face to fit the contour of the inside of the SCV.

In some cases for Content Envelope C.9, for added shielding, a Shielded-Pig Convenience Container configuration, with a machined lead pig and an engineered, aluminum convenience can, is placed inside the PCV, using top and bottom, aluminum honeycomb spacers [see 5(e)(3)].

(3) Drawings:

The packaging design is defined by the following Savannah River Site drawings:

R-R2-F-0026, Revision 2
R-R2-F-0019, Revision 6
R-R2-F-0020, Revision 7
R-R2-F-0025, Revision 2
R-R2-F-0018, Revision 5
R-R3-F-0016, Revision 10
R-R3-F-0015, Revision 5
R-R4-F-0054, Revision 9
R-R4-F-0055, Revision 4
R-R2-F-0037, Revision 1
R-R4-G-00047, Revision 1 (Required for Content Envelop C9 only.)
R-R4-G-00048, Revision 1 (Required for Content Envelop C9 only.)
R-R4-G-00051, Revision 1 (Required for Content Envelop C9 only.)

(b) Contents:

(1) Type and Form of Material:

(i) Uranium metal or oxide as specified in Content Envelope C.1 in Table 1.

(ii) Plutonium-238 heat sources as specified in Content Envelope C.2 in Table 1.

(iii) Plutonium and/or uranium metal as specified in Content Envelope C.3 in Table 1.

(iv) Plutonium and/or uranium oxide as specified in Content Envelope C.4 in Table 1.

(v) Plutonium composites as specified in Content Envelope C.5 in Table 1.

(vi) Plutonium/tantalum composites as specified in Content Envelope C.6 in Table 1.

(vii) Plutonium-238 oxide/beryllium metal as specified in Content Envelope C.7 in Table 1.

(viii) Neptunium oxide as specified in Content Envelope C.8 in Table 1

(ix) Uranium 233 oxides and metals as specified in Content Envelope C.9 in Table 2

Table 1 - Content Envelopes

	Material	C.1	C.2	C.3	C.4	C.5	C.6	C.7	C.8
		U Metal/Oxide	^{238}Pu Heat Sources	Pu/U Metals	Pu/U Oxides	Pu Composites	Pu/Ta Composites	^{238}Pu Oxide/ Be Metal	Neptunium Oxide
Radioisotope (Maximum Weight Percent of Radioactive Material Mass)	^{236}Pu		1×10^{-4}					1×10^{-4}	
	^{238}Pu		100	2	2	0.05	0.05	80	5×10^{-2}
	^{239}Pu		40	100	100	100	100	40	8.8×10^{-3}
	^{240}Pu		13	50	50	6.5	6.5	13	1.5×10^{-3}
	^{241}Pu [a]		1	15	15	1	1	1	1.4×10^{-4}
	^{242}Pu		1.5	5	5	0.1	0.1	1.5	7.7×10^{-4}
	^{241}Am + ^{241}Pu		1	15	15	1	1	1	2.3×10^{-4}
	^{243}Am		1×10^{-4}	1×10^{-4}	1×10^{-4}	1×10^{-4}	1×10^{-4}	1×10^{-4}	
	^{244}Cm		1×10^{-4}	1×10^{-4}	1×10^{-4}	1×10^{-4}	1×10^{-4}	1×10^{-4}	
	^{237}Np		0.5	5.0	5.0				100
	^{232}U	1×10^{-5}	4×10^{-6}	1×10^{-5}	1×10^{-5}				
	^{233}U	0.5	0.2	0.5	0.5				2.4×10^{-3}
	^{234}U [b]	100	40	100	100				0.47
	^{235}U	100	40	100	100				0.47
	^{236}U	40	16	40	40				0.19
	^{238}U	100	40	100	100				0.47
	^{232}Th		10	23[d]	23[d]				2.3
Impurities (grams)	Al, B, F, Li, Mg, Na			c	c				8.0
	Be			500	500	4,400		200	0.60
	V					4,400			
	Ta					4,400	6,000		
	C			1,000	1,000				20
Total mass (kilograms)	Radioactive Materials	13.5	0.1	4.4	4.4	4.4	2	0.02	6
	Impurities			3.08	3.08	4.4	6	0.2	0.07
	All Contents	13.5	0.1	4.4	5	4.4	8	0.22	6.81

a: ^{241}Pu must be less than ^{240}Pu.
b: Applies to ^{234}U other than ^{234}U resulting from ^{238}Pu decay.
c: The listed light element impurities have a combined mass limit of 3080 grams minus the mass of Be and present.
d: Or up to 1000 g total ^{232}Th.

Table 2 – SARP Addendum 2 Content Envelope C.9

	Material [a]	C.9 ^{233}U Metal/ Oxide
Radioisotope [b] (Weight Percent of Radioactive Material Mass)	^{236}Pu	
	^{238}Pu	
	^{239}Pu [c]	d
	^{240}Pu	e
	^{241}Pu [c]	e
	^{242}Pu	
	^{241}Am + ^{241}Pu	e
	^{243}Am	
	^{244}Cm	
	^{237}Np	
	^{232}U [c]	0.0018 grams [f]
	^{233}U [c]	500 grams [g]
	^{234}U	d
	^{235}U [c]	d
	^{236}U	100
	^{238}U	100
	^{232}Th	
Impurities (grams)	Al, B, F, Li, Mg, Na	
	Be	
	V	
	Ta	
	C	
	Ni [h]	100
Total Mass (kilograms)	Radioactive Materials	4.4
	Impurities	
	All Contents	4.4

a. All contents shall be dry except for oxides, which shall have moisture less than 0.5 weight percent of the radioactive material mass.
b. Maximum amounts by constituent.
c. Nuclide classified as "fissile" per DOE Good Practices Guide, Criticality Safety Good Practices Program, Guide for DOE Nonreactor Nuclear Facilities, DOE G 421/1-1, 3.79 *Fissile Nuclide*, 8-25-00.
d. These isotopes may be present as long as their contribution as equivalent ^{233}U in the package combined with the actual ^{233}U content present does not exceed the ^{233}U mass content limit. The "equivalent ^{233}U" mass is given by the equation ^{233}U(eq) = ^{233}U + ^{235}U/1.4 + ^{239}Pu/0.83 for the three primary fissile isotopes where each isotope name indicates the mass of that isotope. Any ^{234}U present shall be considered ^{233}U for this equation.
e. Small quantities (<1g) of these isotopes may be present as long as the ^{240}Pu mass exceed the ^{241}Pu mass, their combined mass is less than the ^{239}Pu mass, and these isotopes are treated as ^{239}Pu in the determination of ^{233}U(eq) mass.
f. 0.0018 grams is the limiting mass of ^{232}U based on the 9975 package shielding. This mass limit increase to 0.0101 gram if the material is shipped in the Shielded-Pig Convenience Container Configuration [see Addendum 2 5(e)(3)].
g. This mass value is the minimum subcritical mass limit for ^{233}U (ANSI/ANS-8.1).
h. When present, nickel is plating used to fix contamination on the welded stainless steel capsule encasing the uranium source material.

(2) Maximum Quantity of Material per Package: as specified in Table 1.

For the contents described in 5(b)(1)(i) through 5(b)(1)(viii):

(i) The maximum decay heat per package may not exceed 19 watts.

(ii) The maximum weight of all material (radioactive contents, product cans, spacer, etc.) inside the PCV may not exceed 20.1 kg (44.4 lb).

(iii) Except as permitted for oxides, all contents shall be dry.

(iv) Pu/U content bulk density shall be no greater than 19.84 g/cc. No minimum bulk density is specified. However, low bulk densities may require dilution of the local atmosphere within the content container by a specific gas (helium or nitrogen) and/or reduction in the allowable decay heat as summarized in Addendum 1 Table 3.1.

(v) Except as stated in Table 1 or Table 2, small concentrations (<1000 ppm each) of other actinides, fission products, decay products, and neutron activation products are permitted.

(vi) Except as stated in Table 1 or Table 2, inorganic material impurity quantities of less than 100 ppm each are permitted so long as the total mass is less than 0.1 weight percent of the total content mass.

For the contents described in 5(b)(1)(i):

(vii) Up to 1 gram of plutonium contamination is permitted.

(viii) Each metal piece shall have a minimum thickness of 1.0 mm (0.04 inches) and a specific surface area less than 100 mm^2/gram (71 in^2/lb) per DOE-STD-3013.

For the contents described in 5(b)(1)(iii):

(ix) Each metal piece shall have a minimum thickness of 1.0 mm (0.04 inches) and a specific surface area less than 100 mm^2/gram (71 in^2/lb) per DOE-STD-3013.

(x) Contents shall be stabilized in accordance with DOE-STD-3013, Section 6.1.1.

(xi) Plutonium plus uranium mass may not be less than 30 weight percent of the total content mass.

For the contents described in 5(b)(1)(iv):

(xii) Plutonium plus uranium mass may not be less than 30 weight percent of the total content mass.

(xiii) Contents shall be stabilized in accordance with DOE-STD-3013, Section 6.1.2.

(xiv) The moisture content of the oxide shall be less than 0.5 weight percent of the total content mass.

For the contents described in 5(b)(1)(v):

(xv) Each metal piece shall have a minimum thickness of 1.0 mm (0.04 inches) and a specific surface area less than 100 mm^2/gram (71 in^2/lb) per DOE-STD-3013.

(xvi) Contents shall be stabilized in accordance with DOE-STD-3013, Section 6.1.1.

(xvii) Plutonium plus uranium mass may not be less than 30 weight percent of the total content mass.

(xviii) Depleted uranium or enriched uranium may be substituted for any amount of plutonium on a gram-for-gram basis.

For the contents described in 5(b)(1)(vi):

(xix) Each metal piece shall have a minimum thickness of 1.0 mm (0.04 inches) and a specific surface area less than 100 mm^2/gram (71 in^2/lb) per DOE-STD-3013.

(xx) Contents shall be stabilized in accordance with DOE-STD-3013, Section 6.1.1.

(xxi) A maximum of 50 pieces of composite material is permitted.

For the contents described in 5(b)(1)(vii):

(xxii) The 200 grams of beryllium can be in any configuration with up to 275 cm^2 in direct contact with plutonium contents.

For the contents described in 5(b)(1)(viii):

(xxiii) Material shall be prepared in accordance with WSRC-TR-2003-00388, which limits the moisture content of the material.

(xxiv) Up to 250 ppm sulfur and 3000 ppm silicon impurities are permitted.

For the contents described in 5(b)(ix)

(xxv) PCV bottom spacer is required.

(xxvi) Shipments are not authorized in a 3013 or Hex-can

(xxvii) If ≤ 0.0018 grams ^{232}U contents can be in Food-Pack Can. The food-pack can have a maximum of 110 g plastic. Aluminum pellets or foil for packaging is allowed.

(xxviii) If > 0.0018 grams and ≤ 0.0101 grams ^{232}U or determined by dose-rate measurements the Shielded-Pig Convenience Container will be used. The Shielded-Pig and aluminum convenience can manufactured per listed Addendum 2 drawing are required. PCV spacers replaced by Shielded-Pig honeycomb spacers manufactured per the listed Addendum 2 drawing.

(c) Minimum Transport Index for Criticality Control (Criticality Safety Index): 2.0

(d) Conditions:

(1) Content envelope loading arrangements/configurations shall comply with the applicable requirements of Sections 1.2.3.1 and 1.2.3.2 of the SARP (as modified by Addendum 1).

(2) Food-pack cans with organic liners may not be used for any contents.

(3) All food-pack, 3013, or hex cans must be examined for post-sealing bulging or buckling prior to placement inside the PCV. No can that has visibly bulged or buckled may be transported in the package.

(4) Food-pack, 3013, or hex cans shall be inspected upon removal from the PCV after shipment. Any visible bulging, buckling, or evidence of corrosion shall be reported immediately to the DOE Headquarters Certifying Official.

(5) The gross weight of the package may not exceed 183 kg (404 lbs).

(6) For the contents described in 5(b)(1)(v), any package that is subjected to an impact greater than that of a four-foot drop shall be surveyed for neutron dose rate prior to contact or handling.

(7) In addition to the requirements of Subparts G and H of 10 CFR Part 71, and except as specified in section 5(d) of this certificate, each package must be fabricated, acceptance tested, operated, and maintained in accordance with the Operating Procedures requirements of Chapter 7 (as modified by Addendum 1), Acceptance Tests and Maintenance Program requirements of Chapter 8, and packaging-specific Quality Assurance requirements of Chapter 9 of the SARP.

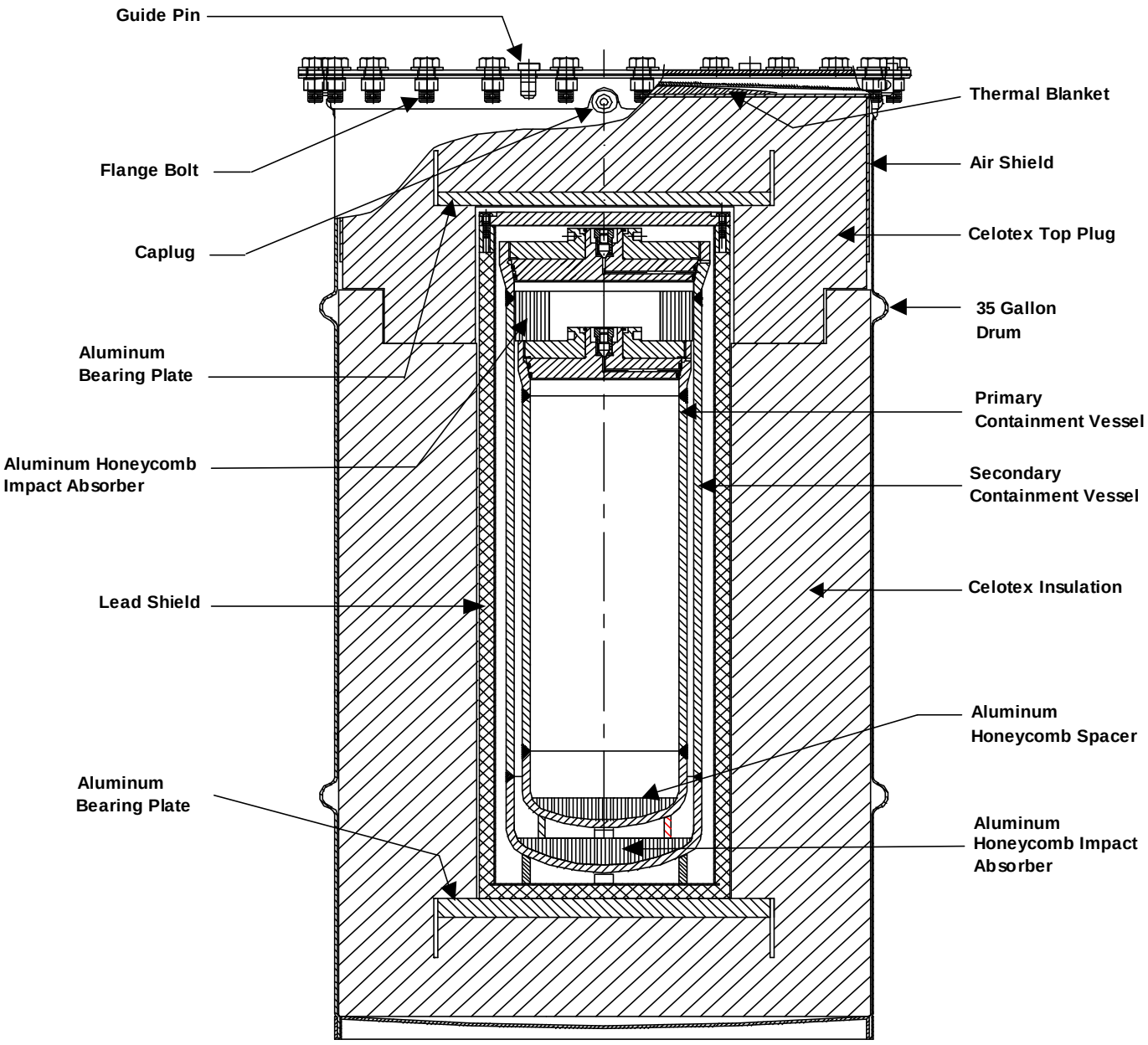
(8) Transport by air of fissile material is not authorized.

(e) References

(1) *Safety Analysis Report for Packaging Model 9975*, B(M)F-85 WSRC-SA-2002-00008, Revision 0, December 2003.

(2) *Safety Analysis Report for Packaging Model 9975, Addendum 1, Justification for Modified Contents Parameters*, S-SARS-G-00001, Revision 0, April 2005.

(3) *Justification for ^{232}U Content Envelope, Safety Analysis Report for Packaging, Model 9975, Addendum 2*, S-SARA-G-00002, Revision 1, May 2008.



9975-85 PACKAGING

PACKAGE CERTIFICATION APPROVAL RECORD

Certificate of Compliance USA/9975/B(M)F-85 (DOE), Revision 20
9975 Package

Docket 08-19-9975

Revision 20 of Certificate of Compliance USA/9975/B(M)F-85 (DOE) for the 9975 package has been issued to add the contents Uranium 233 oxides and metals as specified in the new Content Envelop C.9.

This certificate constitutes authority for the Department of Energy to use the 9975 package for shipment of the authorized contents under 49 CFR 173.7(d).

Dae Y. Chung
Headquarters Certifying Official
Deputy Assistant Secretary
Office of Safety Management and Operations for
Environmental Management

Date 8/21/08